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ABSTRACT

This report summarizes a working conference held at the Educational Technology Center in the Harvard University Graduate School of Education to explore the uses of educational technology in urban schools and offer recommendations for developing policies and programs. Participants included urban practitioners, researchers, professors, policy analysts, and representatives of community-based institutions, computer corporations, and corporate and private philanthropy. Presentations and discussions focused on such concerns as the need to insist on equity in the distribution of computer hardware and software to all schools; community and parent involvement in bringing computer programs to the urban schools; whether urban students need to be computer literate, particularly as this relates to obtaining employment; and the need to incorporate computers into vocational programs in order to give these students a broader educational experience. The conference emphasized that insistence on equity in the distribution of computer hardware and software to all schools is the first step toward excellence, and it is noted that teachers and administrators who believe in their students' potential to learn and in the use of computers as a tool for motivating and educating them, will be needed if these goals are to be reached. A list of conference participants is appended, and a 13-item bibliography is provided. (Author/EW)

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Computers, Equity, and Urban Schools

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Computers, Equity, and Urban Schools

Computers, Equity, and Urban Schools

This report stems from a conference held at the Educational Technology Center, Harvard University, in November 1984. Major support for the conference came from the Ford Foundation, with additional support from the National Institute of Education.

Bruce Astrein and Adria Steinberg of Centre Research prepared the conference report from notes, recordings, and transcripts of discussion. Mike Prokosch was responsible for designing, typesetting, and printing this volume.

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Preface

On November 29 and 30, 1984, the Educational Technology Center, with the support of the Ford Foundation, sponsored a working conference to explore issues surrounding the uses of educational technology in urban schools. The objective of the conference was to examine the complex web of hopes, fears, possibilities and constraints which surround these issues, as well as to recommend next steps in developing sensible policies and programs.

The twenty-five people participating in the conference included urban practitioners, researchers, university professors, policy analysts, representatives of community-based institutions, computer corporations, and corporate and private philanthropy. (See Appendix A for complete list of participants.) Participants were chosen because they represent a variety of perspectives, yet have in common a concern about the schooling experiences of those young people who share least in the material benefits and economic opportunities of the society.

This seemed the right moment to bring together such a group. Discussions about the educational uses of technology have been conducted in isolation from discussions of the ongoing access, equity, and quality issues central to urban education. There is enough experience with the uses of educational technology, and enough knowledge about the needs and resources of urban schools and communities, to consider in a comprehensive way the potential costs and benefits of the technology.

Four formal presentations framed discussion and debate at the conference. Kenneth Haskins delivered the keynote address, which emphasized the centrality of equity issues. Joseph Weizenbaum spoke on the potential and problems of the new technology; Henry Levin presented information on the economic context; and James Breeden discussed the obstacles to implementing new programs in urban schools. While not directly responsible for the implementation of computers in urban schools, the presenters are all individuals whose work and temperament involve them in thinking broadly about the needs of urban schools and communities, as well as the possibilities and problems that are raised by computer technology.

It is difficult to convey the richness and complexity of the discussion that took place at the conference. The presentations served as a catalyst to heated debates, which usually led to a clarification of positions and to incremental shifts in opinion rather than dramatic resolutions. As expected, the conference raised as many questions as it answered. Nevertheless, participants agreed on some priorities and reached consensus on several recommended next steps.

Many issues were raised that deserve continuing attention from those who make, influence, and carry out educational policy at the city, state and federal level, as well as from supporters of educational progress including the Ford Foundation. We hope that this report on the conference provides useful guidelines for research and change efforts that will help make educational technology a positive force in urban schooling.

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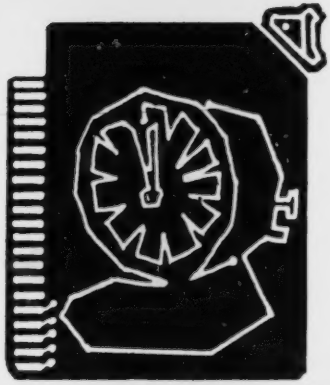
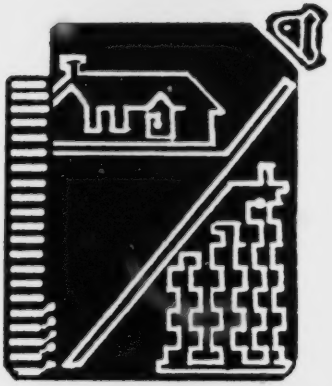
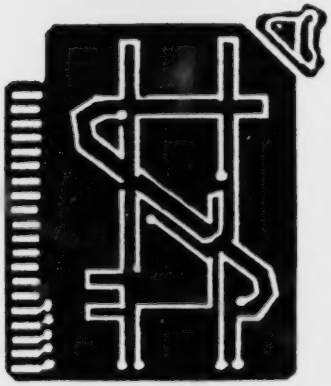
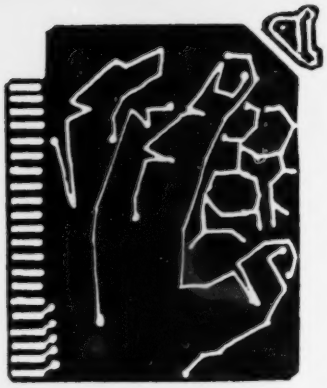






What Are the Issues?



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What Are the Issues?

The introduction of computers into the schools is proceeding at a rapid pace. About one million microcomputers are currently in use in the schools, a considerable increase over the 96,000 estimated in 1979. Educational software has become a billion dollar industry. Parents, teachers, principals, superintendents, and school boards across the country are calling for more computers at all levels of schooling. The impetus to bring computers into the schools is fueled both by the widespread belief that students must meet standards of "computer literacy" for basic functioning in tomorrow's society and job market, and by the view that computers have great potential to improve the quality of education through computer assisted instruction.

While most people involved in the enterprise of public education share these basic assumptions, a small but growing number of school practitioners, policy analysts, computer scientists, and community groups are questioning and even challenging them. They warn that the current "technological imperative" will have negative consequences for the schools; at best, absorbing resources which could be used to support a broader range of effective educational approaches, and, at worst, diverting students from the competencies and knowledge they will need for their future lives as citizens and workers.

For people concerned about urban children and urban schools, this debate has a particular urgency. In the context of limited resources, with the education and life chances of children at stake, policymakers and all those who influence policymakers cannot afford to make mistakes. In the past three decades, the composition of urban schools has changed dramatically. The vast majority of those attending urban schools now come from low-income families, many of which are headed by single parents. Blacks and cultural and linguistic minorities constitute the majority of the school population in 25 of the 26 major urban school districts.

"The introduction of computers into schools will not change the response of schools to poor and black kids. The focus on technology must not divert us from the moral and political concerns that are more the cause of problems than the lack of computers."
Kenneth Haskins

Urban schools have had difficulty adapting to this new and diverse population. Perhaps the most dramatic indicator is the rising dropout rate, which, in the words of Stephanie Robinson of the Urban League, is nothing less than a "time bomb" in our cities. In most urban areas, more than half of the students who begin ninth grade leave before their high school graduation. Studies of particular high schools in New York and Chicago have revealed dropout rates as high as 75 percent. Furthermore, many of the students who remain in school do not receive a high quality education. Student achievement in urban schools is considerably below the national norms.

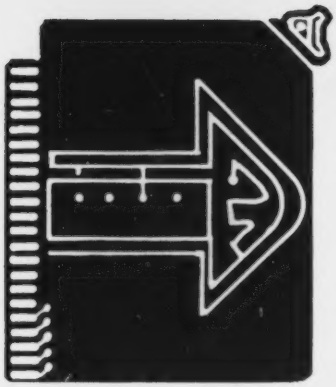
The sweeping demographic changes of the past three decades have not been accompanied by sufficient resources to meet the needs of the new school populations. In fact, in the past several years urban schools and communities have experienced a disproportionate share of the federal cutbacks, especially in services to low-income families and children. In a period of limited resources and increasing needs, it is not difficult to understand why many urban schools have greeted the arrival of new computers as an occasion for rejoicing, or at least guarded optimism. Computers are a resource, and one that is becoming more and not less available.

Yet, the question remains: Will computers significantly improve the education and life chances of the poor and minority children who constitute the majority of the urban school population? Or should the introduction of computers be viewed more skeptically, as one more panacea that will not live up to its promises?

Clearly computers alone will not solve the problems of urban schools. With or without computers, urban schools must address the issues that have long been central to the struggle for equal access to quality education. The low expectations, racism, differential access, and discriminatory treatment that continue to characterize some urban schools and undermine the education of many urban students will require moral and political as well as technological solutions.

The primary challenge is to find ways to use this new resource to improve the education and life chances available to poor and minority students. After several decades of only limited progress with conventional approaches to providing quality educational services to disadvantaged students, the hope is that the microcomputer will serve to galvanize new and vigorous reform efforts in urban schools.

In his keynote address to the conference, Kenneth Haskins articulated the mixture of hope and caution that was echoed throughout the two days: "The mere introduction of computers into city schools will not alter the current institutional response to students and families that are poor or of African descent. In fact, the current focus upon technology, if not tempered, diverts us from the moral, intellectual and political concerns that are in all probability more the cause of city school problems than the absence of computers. Introducing this technology without addressing other considerations will lead once again to alleged proof that 'something was tried and did not work.' The discussion of computers in urban schools does provide an opportunity to rephrase some old questions and raise others that may be new."

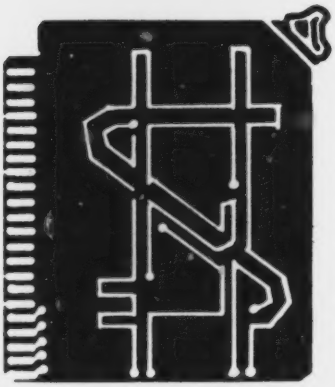


Access

Children need equal access to the benefits of computers. This was a point of unanimous agreement at the conference and probably general agreement among urban educators across the country. Yet this statement raises as many questions as it answers. What constitutes equal access? How is it measured? When can we be comfortable that we have achieved it? Can we, at this point in the technological revolution, be certain in our identification of the benefits of computers?

"Urban children must have access to technology at least as sophisticated as that available in suburban areas, opportunities to pursue learning at least as broad and quality that is perhaps greater."
John Grate

Until recently the most vexing resource issue was the difficulty of acquiring enough hardware to provide for a concentration of experience. But, it is becoming increasingly clear that there are also numerous other aspects to the successful utilization of computers in schools. Students need access not only to hardware, but also to software that is relevant and functional in urban settings. They need access to teachers who combine subject matter knowledge, comfort with technology, tolerance of ambiguity, and willingness to share intellectual authority, and who have been supplied with appropriate materials. Finally, they need to be in a school environment that supports the creativity of both its teachers and its students. 5



Hardware

The first step for urban schools is to provide their students with access to computers. Thus far, the process of acquiring hardware has been slower in urban schools than in suburban ones. Between two-thirds and three-quarters of the richest U.S. schools have at least one microcomputer, but about 60 percent of the poorest schools have none. Although exact urban/suburban comparisons are not available, it seems generally true that the wealthier the community, the more likely it is that students have regular access to computers in their schools. This has a great deal to do with the inequitable way schools are financed, with the majority of funding dependent on the local tax base.

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Ironically, federal monies, which should work to offset resource inequalities, may actually have contributed to the computer gap. School interest in computer technology coincided with the repeal of the Emergency School Assistance Act, which was replaced by the block grant funding of Chapter II of the Elementary and Secondary School Act. Suburban schools quickly began spending this block grant money on the purchase of computers, while urban schools had to use it on more basic needs programs that had been cut back or eliminated.

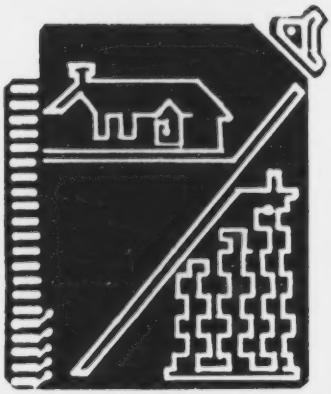
Recently, urban schools have begun to use Chapter I (formerly Title I) funds for the purchase of computers. Chapter I provides for remediation for economically and educationally disadvantaged students. Although the use of these federal funds has served to reduce the resources gap, it means that there are very strict guidelines governing the use of computers in many urban schools. Computers bought with Chapter I funds can only be used for remediation purposes, with students who are both poor and at least 2 years behind grade level in English and or mathematics. Suburban schools which purchase their computers out of local funds or Chapter II funds have no such restrictions on usage.

"The wholesale adoption of computers in schools has been driven by bake sales more than by educational research that demonstrates effectiveness."
Paul Evans

"We are already introducing computers in a way that increases the resources gap between rich and poor. The very technology that could be a leveling force is accentuating differences between haves and have nots."
John Lawson

This urban/suburban disparity in the numbers of computers available to students has been the subject of intense concern in a number of urban communities. Extensive efforts are being made to find public and private funding to support the purchase of hardware for the schools. The recent reduction of the resource disparity, however, has come about less as a result of these efforts and other ongoing efforts to correct basic inequalities in the financing of schools, than through the coincidence of the hardware itself becoming much less expensive.

Even the reduction in the cost of hardware is probably benefiting suburban schools more than urban, however. As the cost of microcomputers has dropped, parent and civic organizations and, in some cases, businesses and corporations in many suburban communities have purchased additional machines for their local schools. One study indicates that it is more likely for schools which already have computers to acquire additional machines than for schools without any computers to procure their first piece of hardware.



Differential Uses

The acquisition of hardware is necessary, but not sufficient. The issue of equity encompasses far more than the calculation of measurable inputs, such as the ratio of computers to students. Ultimately the resource gap may prove easier to deal with than the more subtle issue of the differential uses of computers in urban and suburban settings. Stephanie Robinson articulated the concern many people are feeling: "I'm worried about the drill and practice mentality . . . The danger is that computers will be used as workbooks in urban schools, and as resources for creative thinking and research in suburban schools."

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Most of the participants in the conference shared this worry. Certainly this pattern has been observed before. Comparisons of urban and suburban schools reveal significant differences in curricular content, instructional practices and student-teacher relationships. On the whole, poor and minority students are more likely to spend time on rote learning and less likely to be asked or expected to make judgments, draw inferences or engage in critical thinking or problem solving.

This pattern is already observable in the differential uses of computers in urban and suburban schools. On the whole, computers are more likely to be used exclusively for drill and practice in urban schools. More affluent suburban schools, which have had the hardware for longer, are more likely to be experimenting with a range of uses, from programming to accessing data bases for content areas in the curriculum.

"The real bias falls in the area of software and the uses of hardware and software."
Asa Hillard

To some extent schools are being forced to replicate this pattern by the financial inequities between urban and suburban systems. Suburban schools have more funds available not only for hardware, but for the multiple costs involved in finding diverse and creative uses for computers in the schools. In the past several years, a number of studies of the costs of computer assisted instruction have consistently shown hardware to be a small percentage of the total costs. According to a 1984 study of several school systems (Levin, 1984b), the annual costs of the non-hardware components were nine times as great as the hardware. Computer hardware accounted for only about 11 percent of the cost of the intervention, down from about 28 percent in 1978.

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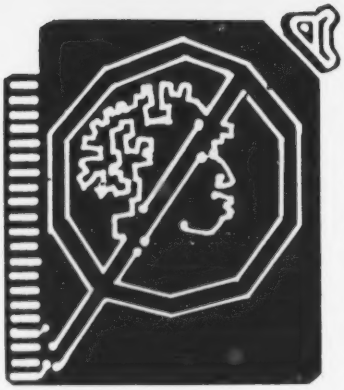
It is becoming increasingly clear that there are many hidden costs associated with the utilization of computers in schools. The full set of requirements for providing adequate instructional services include the computers and other hardware, software, personnel, facilities, teaching materials and provisions for maintenance. If urban school systems are not able to invest enough funds to cover all of these costs, the quality of instruction with computers suffers.



Software

In addition to the high cost of software, urban schools face the problem that much of the software being developed is geared to white, middle class students. Software companies have been particularly slow to respond to the urban school market. The Houston school district could not find a software publisher in the country that was willing to develop materials appropriate for bilingual and ESL instruction. They had to invest over one million dollars for the in-house development of software that would be relevant and functional for their school system, with its large Hispanic population.

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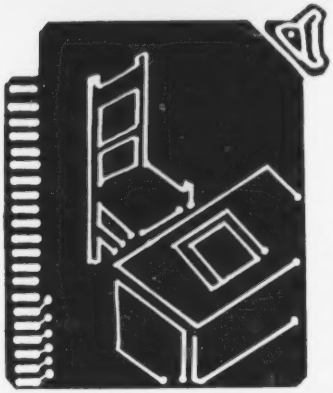
Even when direct bias is not the issue, much of the software available to schools falls far short of anyone's vision of quality education. While some studies have produced evidence that computer assisted instruction can be effective in raising basic skills test scores, many critics point to the unimaginative software that creates, in effect, an electronic workbook. Drill and practice can be effective in reinforcing certain skills, but certainly will not lead to the empowerment of the learner or to the development of critical thinking skills.

"We have to take care not to address issues that are compensatory, but instead issues that are empowering."
Kenneth Haskins

Some critics suggest that the software now in use in many schools is so inadequate and the ideas of how to use computers so limited that computers are nothing more than a costly distraction from the real learning that should be going on. In his presentation to the conference, Joseph Weizenbaum challenged the group to consider whether "the equity picture is upside down." As he put it: "Suburban kids are at a disadvantage because of of the time they are wasting on computers." Certainly the paucity of good educational software is a problem for all schools. But, insofar as more afluent school systems have more funds for purchasing and developing software, and training teachers to use it, their students are still more likely to experience more creative applications of the technology.



Teacher Shortages and Teacher Competency

The lack of resources for attracting, training, and sustaining a competent teaching force is quickly becoming a major issue in urban school districts. Growing teacher shortages in such critical areas as math and science mean that schools cannot offer the full range of courses that they should, and sometimes result in teachers with no special competence in these areas being pressed into service.

Some school districts are viewing educational technology as part of a strategy to address these problems. Patricia Sturdivant, the Director of Technology for the Houston Schools, argued that the dearth of good teachers in certain areas can be addressed only through well-integrated, effective use of technology. Advocates of this position point out that teachers who are new to a subject area will become competent in that area more quickly if they are equipped with computers and relevant software, and that the opportunity to teach in a technological context might attract teachers from industry or other nontraditional sources.

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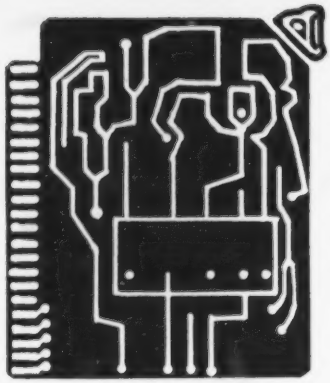
Whether computer-based instruction should ever be used as a substitute for teachers is a more controversial issue. Some administrators argue that if competent teachers are not available, it is acceptable and probably desirable to offer computer-based instruction. Critics of technology, on the other hand, such as Joseph Weizenbaum, object strongly to this strategy. In his view, the aspects of instruction which technology cannot replace are the most important ones; it is better, therefore, to teach something else than to teach by computer alone.



The Importance of Teacher Involvement

Although debates concerning the best combination of teachers and computers could not be resolved at the conference, participants did agree on one major point. The human resource most important to creative and effective uses of educational technology are teachers who understand how, when, and when not to use technology to augment or replace existing educational practice. As Barbara Jackson, the principal of a Boston elementary school, noted, "Creative teaching with computers is what it is all about." Yet she added, "There is a vast difference between the people producing the materials of this revolution, and the people using them every day."

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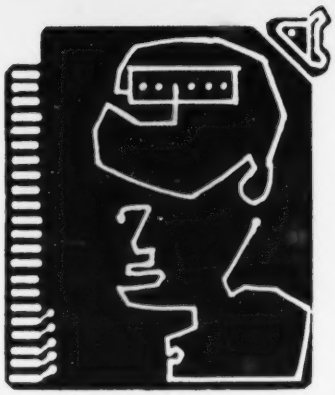
Many teachers feel a lack of control, or even involvement, in the application of computers in their schools or classrooms. In most elementary schools, the teacher must work within a set schedule of classroom computer time. They themselves have only limited access to the hardware and little if any choice as to which software is ordered. In secondary schools, computer science is usually taught by one or two people, often within the mathematics department. Other staff have little exposure to the possible other uses of the new technology.

It has been demonstrated over and over again that when teachers are not involved in formulating, developing and carrying out new programs, when they feel uncertain about the value of the programs, their own effectiveness is undermined and they create barriers to change. These barriers are familiar to anyone who has studied change in educational organizations. In short, teachers change little about their educational practices and adopt the attitude that "this too will pass."

"My teachers started this. They were looking for something to turn kids on, to reach the urban child who's disenchanted with books, or crayons... They have taken courses on their own time... Many of them want their own microcomputers in their classrooms."
Barbara Jackson

In some schools teachers have been the ones to initiate the acquisition of computers. More often, however, teachers express a level of uncertainty about this new technology. Most of them have no previous training or experience with computers and feel they need to understand the technology better before they feel comfortable with it as a teaching tool.

How, then, can teachers be encouraged and supported to use computers creatively? The major way to create the necessary level of comfort and to sustain the initial excitement is through extensive, high-quality staff development work. Yet funds for staff development rarely flow in proportion to the flow of machinery and software into urban schools. Exacerbating the inadequacy of staff development is its maldistribution, which parallels that of the technology itself.



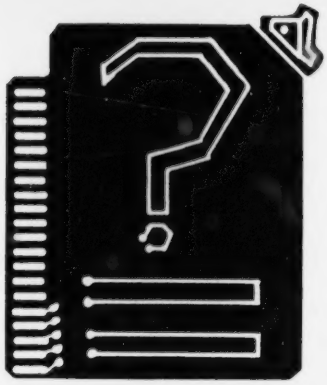
Parent Involvement

The inequities inside of school are compounded by the inequities outside of school. In poor and minority communities, computers are a rare commodity. Most parents have little if any access to the technology their children might be using in school. Yet parent involvement has been demonstrated to be an important ingredient to the success of school innovations. Students learn best when the learning that takes place at school is reinforced outside of school. They need the opportunity to share what they are learning with their families and friends, to gain approval for the skills they are developing, and to see applications of those skills in the "real world" outside of school.

Students also need opportunities for more casual and less pressured use of the technology. In most elementary schools, students have less than an hour of computer time in a week. In most high schools, if students do not elect to take the computer science courses, they will have little if any exposure to the technology. And, of course, the less exposure to the technology, the less likely they are to sign up for computer courses.

"We need to involve parents in the education of their children, including computers."
Patricia Sturdivant

Perhaps the most serious problem resulting from the lack of computers in urban communities is that without access to computers, parents and other community residents do not feel enabled or entitled to participate in discussions of the potential and pitfalls of the new technology, either for their children or for all children. Access to computers at home or in the community, as well as in school, is a necessary step towards technical literacy for poor and minority people. Such access lays the groundwork for parent participation, both in the education of their own children and in the school wide issues related to bringing computers into the schools.

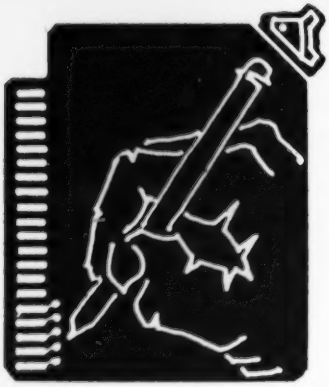


Whose Needs Will Be Served?

At this point, however, there is a serious lack of participation of parents, community members, teachers, administrators, and students in the planning, design, implementation, and evaluation of computer hardware and software. Crucial decisions are being made far from urban school settings. One serious consequence, noted at the conference by Stephanie Robinson, is the lack of attention to the issue of equity. "Equity must and should be a constant concern in program design and development and in the design of research projects. Who is the research sample? Whose targets of difficulty are these?" If equity does not become a central concern until after the hardware has been purchased, it is little more than an afterthought. 15

"A key issue is who gets to shape where technological innovation is going to go in education. Thus far it has been an an unrepresentative sample."
Karen Sheingold

The result of this lack of participation is likely to be products that do not serve the needs of poor and minority children. As James Breeden pointed out in his presentation to the conference: "The interests of the urban poor in computer technology may be different from, even hostile to others in the society. A lot of people interested in computers in schools are not interested in education, but in sales." Judah Schwartz offered the additional observation that: "Software generation is taking place outside communities of the poor, reflecting alien purposes and views."

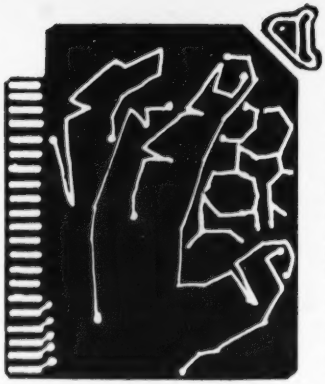


Empowering the Learner

The introduction of new technology into urban schools raises once again the issue of the role poor and minority communities can and should play in shaping the programs that influence the futures of their children. How can poor and minority communities gain assurances that computers will serve their needs and those of their children, while furthering the central goals of justice and equality? For the past thirty years, the desire for access to quality education has led urban communities to struggle for greater control over the schools. These struggles have included demands that the schools hold higher expectations of and for their children, and that race and social class not be used to excuse poor education.

These same concerns are being brought to bear now around the uses of computers. While the most widespread use of computers in urban schools thus far is probably for remediation in the form of relatively unsophisticated drill and practice, the hope among many parents and educators is that the potential benefits of computers will extend far beyond raising basic skill scores. Computers can serve, for example, as a tool for improving student self-concept and motivation and eventually, as students master the technology, as a way of empowering students and giving them the ability for lifelong learning. Furthermore, the potential for individualizing instruction and using learning approaches that are highly interactive and imaginative leads to the hope that computers could change the dynamic in the classroom, improving teacher expectations of students and learners' expectations of themselves.

"The computer is improving the quality of life for the urban child . . . it is giving them empowerment."
Barbara Jackson



Learning and Earning

Traditionally, Americans have expected their schools to accomplish several major purposes: to teach children the academic skills and knowledge that have been deemed essential, to prepare future workers for satisfying and productive careers, to help each child fulfill his or her unique potential, and to prepare children from diverse backgrounds for effective participation in a democracy. In this period of economic change and uncertainty it is not surprising to find an increasing emphasis on the vocational functions of schools.

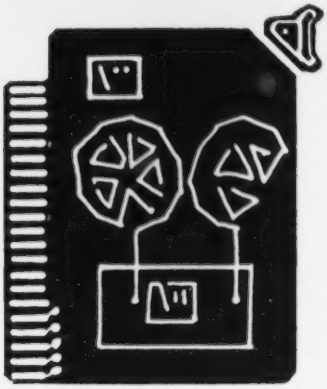
For poor and minority people, the connections between access to quality education and access to quality jobs remains of primary importance. Schools have long been viewed as the "gateway to opportunity" and, as such, held responsible for preparing students for jobs that would enable them to live a good life.

Many advocates of computers in schools see them as the best way to prepare students for employment in a technologically developing society. Thus, by calling for more computers in the schools and attempting to play a significant role in how these computers are used, people hope to make a difference both in the quality of education available to their children and the quality of life.

In many of our urban communities today, the ability to earn a living has become an overriding concern. Nationally, nearly 50 percent of the minority youth actively looking for jobs cannot find them; this is double the unemployment rate for white youth. For minority youth who are dropouts, the unemployment rate climbs to about 65 percent. In areas of the country hardest hit by deindustrialization, unemployment rates as high as 87 percent have been calculated for groups of poor and minority youth. Perhaps more disturbing is the fact that minority youth joblessness remains high even in areas experiencing economic growth and recovery.

"Equality of employment opportunity requires technical knowledge. Technological developments are happening in many fields now . . . Minorities should have a crack at even the few opportunities . . ."
Jose Cárdenas

In the face of these realities, it is not surprising that many people are looking to the schools to provide the technological expertise and knowledge that they believe will assure poor and minority youth of equal employment opportunity. Computers have become important in the schools in large part because of the assumption that they are becoming important in the workplace. At the same time, economists, community leaders and educators are raising important questions as to whether decisions about education should be narrowly geared to the labor market. There are important ongoing debates about the exact shape of that labor market in the next decade and beyond, and about the implications of that job market for education.



Educational Reform and Economic Survival

Will students need technological expertise and knowledge in order to have a fair shot at employment? What types of jobs offer the greatest number of openings, now and for the next 10 to 20 years? What are the effects of new technology on traditional jobs? In the changing and unstable economic conditions of today, these have become hotly debated questions.

In 1983, a series of national reports on education captured the imagination of the American public by linking educational reform to economic survival, both for individuals and the nation. For example, the proposals for educational reform put forth by the Twentieth Century Fund Task Force on Federal Elementary and Secondary Education Policy included the following prediction of the need for higher skill levels in a knowledge-based information society: "In essence, the skills that were once possessed by only a few must now be held by the many if the United States is to remain competitive in an advancing technological world." The National Commission on Excellence in Education put it even more simply: "America's position in the world may once have been reasonably secure with only a few exceptionally well-trained men and women. It is no longer."

Partly as a result of the warnings set forth by these prestigious commissions, it is now widely accepted that changes are needed in the educational system to provide enough skilled workers to sustain the growth of high technology. The conventional wisdom is that as more jobs are tied to computers, workers at all levels will require more sophisticated computer-related skills.

The Shape of the Labor Market

Yet, analysis of current labor market patterns reveals that the majority of jobs being created by the high technology revolution are low-skilled and low-wage jobs. High technology industries do not necessarily produce high skilled, technically oriented jobs. The U.S. Bureau of Labor Statistics has defined technologically oriented occupations to include engineers, life and physical scientists, mathematical specialists, engineering and science technicians, and computer specialists with a minimum of an associate degree. Given that definition it is expected that of the 13-18 million jobs created between 1982 and 1995, only about 6 percent or 1.5 million will be in the technology oriented occupations.

20

Citing research he had conducted (1984a), Henry Levin reported, "For example, only about 15 percent of the jobs in the electronics components industry were technology oriented, while 61 percent were blue collar and the rest clerical. Even the computer and data processing industry has only one quarter of its labor force in technically oriented jobs, and for the automobile industry it is less than 6 percent."

Meanwhile, there has been a significant expansion of service industries, with a proliferation of low-skilled jobs. Five times more jobs are created today for fast food workers than for computer technicians. A young person is considerably more likely to find work as a minimum wage cashier at a grocery store, or fast food worker than as a computer programmer or repair person.

"When you track jobs in absolute numbers you find low-skilled, service-oriented occupations to be at the top of the list . . . "
Henry Levin

The critical question, of course, is whether these trends will continue into the future. Some economists and analysts, like Henry Levin from Stanford University, predict that they will. By combining many different labor market projections, he has calculated a list of the fastest growing jobs, in terms of absolute numbers, from 1982 to 1995.

"Only about 15 percent of the jobs in the electronics components industry are technology oriented, while 61 percent are blue collar and the rest clerical. Even the computer and data processing industry has only one quarter of its labor force in technically oriented jobs, and for the automobile industry is is less than 6 percent."
Henry Levin

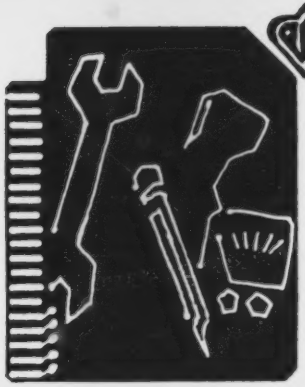
Levin summarized his compilation at the conference. "The top five occupations in terms of the numbers of jobs projected are building custodians, cashiers, secretaries, general office clerks, and sales clerks. No high technology occupations are included among the top 18 expected to contribute the most new jobs to join the U.S. economy, although fast food workers, guards and doorkeepers, kitchen helpers and nurses aides and orderlies are represented on the list. While it is expected that 200 additional computer programmers will be needed by 1995, the growth in jobs for building custodians is expected to be almost 800,000 and for kitchen helpers and fast food workers, about 600,000. Most new jobs will be in low-level service occupations, requiring high school completion or less, or some community college training." 21

This might turn out differently if the structure of the labor market changed, a point Marc Tucker made at the conference. But Levin and Tucker agreed that there is no reason to expect a dramatic increase in jobs requiring technological skills.

Jobs with the most openings, 1978-1990

Occupation	Annual Openings
Secretaries and Stenographers	305,000
Retail Sales Workers	226,000
Building Custodians	180,000
Cashiers	119,000
Bookkeeping Workers	96,000
Nurses' Aides, Orderlies, and Attendants	94,000
Cooks and Chefs	86,000
Kindergarten and Elementary School Teachers	86,000
Registered Nurses	88,000
Assemblers	77,000
Waiters and Waitresses	70,000
Guards	70,000
Blue Collar Worker Supervisors	69,000
Local Truck Drivers	64,000
Accountants	61,000

Source: "Occupational Outlook Quarterly," U.S. Dept. of Labor, Bureau of Labor Statistics, Spring, 1982.

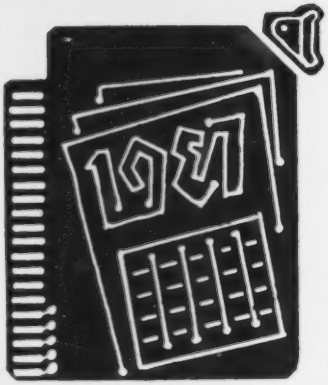


The Effects of Technology on Existing Jobs

Levin also challenged the conventional wisdom regarding the effects of technology on existing, or traditional jobs. While many people assume that more sophisticated skills will be needed as technology is applied to more workplaces, Levin argues that most technology thus far is being used to reduce rather than to raise the skill requirements of jobs. He points to the example of secretaries, many of whose traditional functions have been replaced by word processors. "Word processors can correct typing errors automatically, so letter perfect typing and strong spelling are no longer required. Formats for different types of documents can be programmed into the word processor, and even grammatical revisions can be done through syntactical programs." (Henry Levin)

22 **"Most technological innovation is being used to reduce the skill requirements of existing jobs."**
Henry Levin

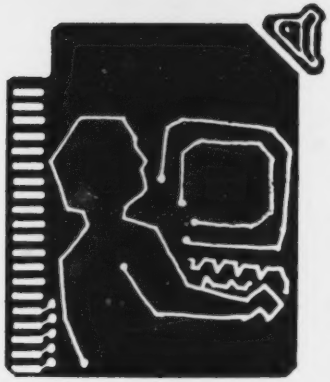
This same trend can be seen in other forms of office automation as well as for computer and computerized machine repair, data processing, auto repair, design, drafting and many other occupations. In many workplaces, microprocessors will be literally invisible. Workers will need to master the operations of a piece of equipment that may be connected to a very sophisticated computer, but they will not need to know anything about the computer itself. "True the computer already pervades our society, but that does not mean you need to understand computers. Most computers, like electric motors, will be invisible." (Joseph Weizenbaum)



Forecasting the Future

Although the analyses of Levin and others have recently gained a certain degree of recognition and legitimacy, many people remain unconvinced. It is difficult to make accurate and reliable predictions about the labor market, especially in a period of rapid technological change. Even in the past, when employment patterns were relatively more stable, the Bureau of Labor Statistics had a wide margin of error. Analysts point to specific industries, such as financial services, where the changes caused by the applications of new technologies are happening so rapidly that they cannot make forecasts beyond 18 months.

The debate is not limited to the predictability of the future, or the reliability of the methodology being used. It encompasses the strategic and political use of the predictions as well. Pessimistic predictions about the shape of the labor market, it is argued, may well become a self-fulfilling prophecy. "If we believe most jobs are becoming deskilled and thus do not require many skilled kids coming out of schools, we are condemning urban schools to poverty . . . If students don't have skills, the response of the industry will be to automate jobs and eliminate jobs . . . If they do, industries will make different investments." (Marc Tucker) 23



Computer Literacy for What?

Given what we know, and what we still do not know about the developing labor market, do urban students need to be computer literate? To what extent do their futures hinge on their technical expertise and knowledge of computers? Despite the ongoing debate about the job market requirements associated with the development of new technologies, the predominant use of computers in the schools is to promote computer literacy. However, neither the justification for computer literacy nor the definition of the term is entirely clear.

Computer literacy most often means the teaching of the BASIC programming language. Yet many people who teach computer science in college and universities agree that learning BASIC is *not* a useful first step to such thinking skills as might be involved in structured programming. Furthermore, even if most schools switched to a different first programming language, such as LOGO, these questions would remain. Finally, there is a serious question as to whether it is necessary or beneficial for elementary or secondary school students to learn programming at all.

"Kids can learn all the technical knowledge they need from a vocational viewpoint after high school . . . You can teach someone to use a word processor in a day or less . . . It is no favor to give anyone trivial skills in the name of giving them a competitive advantage in the marketplace . . . even learning the command structure of the programs in itself is not necessarily a valuable skill . . . People need to have the skills behind it . . . the writing skills, the statistics skills, the thinking skills . . ." (Marc Tucker)

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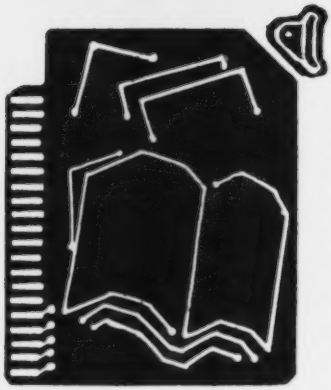
Marc Tucker

The concern about equity for poor and minority students, however, leads advocates to conclude that computer literacy must, at least for now, become a standard part of the curriculum of urban schools. Whether or not computer literacy is necessary for most jobs, it is rapidly becoming an entrance criterion, an essential credential. In this sense computer literacy may well prove to be a new gateway to opportunity. As Asa Hillard put it: "It would be irresponsible to deny to any kids access to this gateway."

In addition, it is crucially important that students be prepared to be informed citizens in an increasingly technological society. While arguing against the need for computer literacy for job preparation, Henry Levin advocates a kind of "technical literacy" for all citizens. "Students will not need more than a high school education for most jobs . . . they will not need computer literacy for most jobs . . . but, we need to be certain to include everyone in the knowledge of technology, not for the job market but for citizenship in a democratic society . . . " (Henry Levin) This suggests the need for a different and broader definition of computer literacy. Ultimately, the teaching of specific programming skills is probably not as important as helping students gain an understanding of the new technologies, both the possibilities and pitfalls.



Lifelong Learning

Whichever predictions of the future job market prove to be more accurate, it is clear that the types of jobs available as well as the nature of many existing jobs will continue to change. And this will create changes in the life-cycle of the average worker. People can expect to change jobs and even careers a number of times during their working lives.

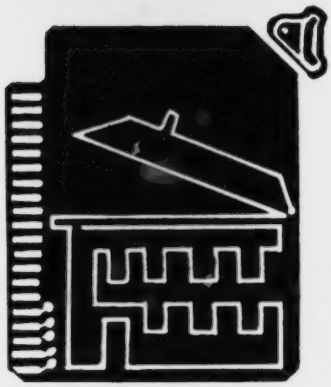
Almost 90 percent of those who will be working in 1990 are already in the workforce today. Given the rapid changes in many jobs, this means that retraining will be crucial, both for individual and national economic survival. "One thing we can be sure of is that there will be lots of transformation of work and changes of jobs during our students' lifetimes. This means they need the ability to learn and continue learning, to benefit from training and retraining."
(Henry Levin)

The very technological transformation that is causing a renewed interest in the vocational function of schools, also appears to be altering and broadening the meaning of "vocational preparation." The danger is that vocational education programs will provide quickly outmoded job skills, while failing to prepare students in the broader ways that will help them deal with the unpredictable issues of a rapidly changing economy. Ironically, the concern for vocational relevance and for individual and collective economic survival is leading us back to a reassertion of the need for an excellent liberal education for all students.

"We are proceeding with caution and concern. We do not view secondary schools as narrow job training, but preparation for a wide set of options. If suburban kids can use computers as tools for learning, urban kids need it too."
John Grate

Recently when a panel of employers convened by the National Academy of Sciences identified the areas in which it was essential that high school graduates be proficient in order to be effective employees, they came up with a list of 10 core competencies. These included reading, writing, reasoning, listening, knowledge of estimation, knowledge of technical and scientific principles, interpersonal skills, discipline, computer literacy, and vocational education. The panel concluded that applied vocational skills are desirable only in addition to these core competencies, that the core competencies are the most important and should be the same for high school graduates going to work and to college.

Interestingly enough, a concern for the development and self-sufficiency of urban minority communities leads to a similar conception of core skills and knowledge. Kenneth Haskins made this point quite clearly in his keynote to the conference: "What is the place of liberal education as more attention is given to technological and vocational concerns? In urban communities we still need writers, poets, philosophers . . . Poor communities need to be less dependent, thus we need students proficient in the full range of subject areas and learnings . . . our children need to know their own history and background . . . the contributions of our own people . . . " (Kenneth Haskins)



The Need for Planning

Preparing students for lifelong learning may well require major changes in the educational system that are pedagogical as well as technical. Among school people enthusiasm for this new challenge is tempered by the knowledge of how difficult it is to implement innovation in the schools. In the past, attempts to change the learning process in schools through the introduction of new technology have not been very successful. David Cohen reminded participants that "There is already an enormous incapacity in secondary schools to make use of the old technology . . . so many problems have not been solved." Or, as Sam Husk from the Council of Great City Schools put it, "many institutional problems need to be overcome if computers are to make a difference."

28 **"We spend too much time on the obstacles . . . what stands in the way . . . and fail to question our own inhibitions . . . what keeps us from making things happen. If it works somewhere, maybe it can work everywhere. We need to ask ourselves: 'What is the plan we ought to be making? How should we be carrying it out?' "**
James Breeden

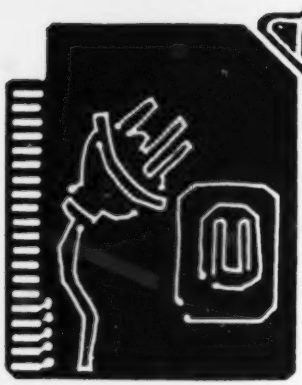
Although the process by which innovation successfully takes hold in schools is not well understood, many people agree that planning is key to making the introduction of computers into urban schools a successful innovation. Robert Peterkin, the Superintendent of Schools in Cambridge, Massachusetts put it simply, "There is the need for a plan that encompasses short and long-term objectives, shared interactions and coordination, evaluation and training." Yet, when the Council of Great City Schools surveyed urban schools they found few clear statements of educational objectives concerning the use of computers. The danger in such situations is that the technology itself will be seen as a "quick fix" that will solve problems in urban education.

Too often it seems as though the purchase of equipment precedes planning. As many school administrators have begun to realize, the successful use of computers in the schools requires much more than hardware. It will involve training and support for staff, and potentially even changes in roles and the ways schools are organized.

"We need to hang our hopes on our plans and goals, not on technology."
Noe Medina

At this point, Houston is one of very few urban school systems to make a comprehensive commitment to using computers as a force for major educational changes. The department of technology, which oversees the integration of all technology efforts, has a staff of 90 and a budget of $4.2 million in the 1984-85 academic year. A great deal of emphasis is being placed on training teachers in the new technologies. This training is viewed as the catalyst to a multi-faceted strategy leading to upgrading the teaching staff and reforming the curriculum.

Teachers who elect to participate in the training are designated as "teacher technologists" and receive a financial reward. They are expected to become change agents in their own school buildings, supporting other teachers in their efforts to use computers and encouraging the involvement of parents as well.



The Difficulties of Planning

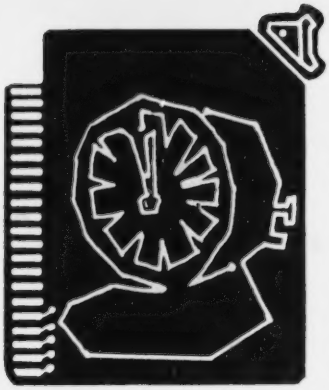
The lack of a larger framework for longer run planning is then compounded by the short-term lack of reliable information or analysis on the cost effectiveness and cost benefits of computers. School administrators are very aware of the need for a more careful examination of such information. Are computers cost effective? Are they the best way of teaching students priority skills?

Given limited resources, the issue becomes one of how to use money wisely. John Grate of the Cincinnati schools argued that administrators need to ask themselves hard questions. "We need to ask ourselves: what portion of the resources of the school district should go towards trying to apply technology to problems? The answer depends on what contribution technology makes to addressing key issues in urban education, i.e. creating incentives to desegregation, increasing the skills of all students."

Although some school administrators may be asking the right questions, the answers remain elusive. The assessment of computer effectiveness is hampered by the lack of shared definitions, by the range of different uses for the computers and by the incredible diversity in the ways computers have been introduced into the schools.

There is no clear agreement among schools and school systems as to whether computer literacy in itself is a learning need, or whether computers are primarily instructional tools to use in the teaching of other subjects. Some argue that the answer depends on the grade level of the students. In Philadelphia, a community planning group came up with the following delineation of goals: "The demand at the elementary level results in two goals: familiarization, at the most reasonable possible costs; and computer assisted instruction in basic skills. There are different issues at the secondary level: the computer as an analytic tool; and better use of out-of-school resources for teacher training and other school improvement." (Barry McLaughlin)

Given the relatively low cost and easy availability of microcomputers, many individual schools have moved ahead on their own. Some systems have a mainframe with terminals in the schools; many others have a hodgepodge of microcomputers, sometimes from a number of different hardware companies. Paul Evans from IBM noted: "The wholesale adoption of computers in schools has been driven by bake sales more than by educational research that demonstrates effectiveness." Those responsible for system-wide or centralized planning are confronted with the need to support the resourcefulness of those in schools while carefully monitoring the results and rationalizing the process of technological innovation.



The Pressure to Act

In the short run, a reasoned approach may not be politically possible. School administrators are having to make decisions without much evidence as to the comparative educational effectiveness of technology. In one study, computer-assisted instruction was found to be more cost effective in increasing students' basic skills than smaller classes or a longer school day, but less cost effective than a well-implemented peer-tutoring program (Levin, 1984b). This prompted Marc Tucker to comment: "There is no evidence that computers can deliver instruction to students in a way more cost effective than all others . . . Schools not awash in resources have tough choices . . . If in investing in computers you have fewer good teachers, it is a poor trade."

32 **"Five years ago urban school systems were criticized severely for not having enough computer education. Now we're being criticized for doing too much without knowing what to use them for . . . public schools cannot freeze on these issues."**
Robert Peterkin

Yet resources are available for the acquisition of computers that would not be available for the implementation of comprehensive peer tutoring or for the hiring of more good teachers. Political exigencies, more than research results, often govern the decisions that are made. The history of urban education in the past 30 years is replete with examples of programs that have been evaluated as effective, and then not supported with enough funds to implement them fully, for example Title I and Project Head Start. At this point urban educators understand that if they want to introduce a new program to meet students' educational needs, it is much more likely to obtain support if computers are involved.

A Solution in Search of a Problem?

As some critics warn, the very availability of computers has created a solution in search of a problem. We cannot decide how best to use computers, they caution, until we deal with the more fundamental questions about teaching and learning. What *should* the schools be teaching? How will education have to change in an age of information? What are the major barriers that prevent urban students from learning? Do computers address any of those barriers? Will computers help urban students to develop essential skills and knowledge?

Yet, urban educators must walk a fine line between moving too slowly and moving too precipitously. Generations of students pass through the schools very quickly. Administrators feel caught between the need to take action immediately and the desire to use this new resource well. On the one hand, they cannot afford to wait for the larger pedagogical issues to be resolved, or for definitive research showing the computer to be the most effective way to do this or that. But on the other hand, they must avoid the pattern of implementing a new idea too quickly, without enough time for planning, or execution, and without sufficient resources or support. Too often this has meant that when the hoped for results are not immediate, the idea is judged a failure, one more thing that has been tried in urban schools and simply doesn't work.

- Are the plans for acquisition and implementation equitable? Are they related to closing the gap between low and high achieving students, as well as raising the level of achievement for all students?

- Have all the costs been taken into account? Are there sufficient funds for hardware, software, teacher training and support, facilities, materials, and repair?

"We are able to solve any technical problem. Computers can do well anything we understand. The harder problem is to know *what* to do, to have a theory of pedagogy and education, to understand what happens in the classroom. There have been great advances in hardware, not in application, and not in the theory of education."
Joseph Weizenbaum

- Is software available that will meet the needs of the students? Can computers be used to develop effective skills for poor and minority students, to reinforce respect for cultural diversity, to raise teacher expectations and student self-image?

- Is the school prepared for the organizational change computers can bring? Are teachers ready for the corresponding change in pedagogy, in classroom management, and in their relationship to students?

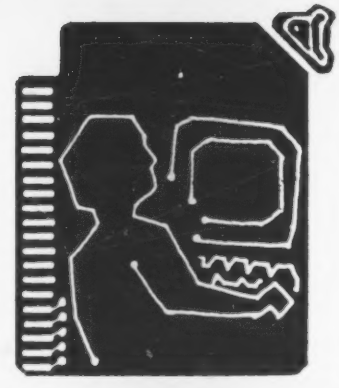
- Will teacher support and training be an integral part of the implementation process? Are the right incentives in place to encourage teachers to make use of this new resource?

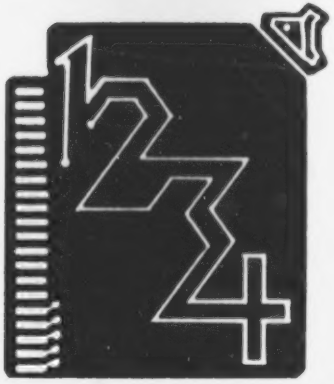
- Will the planning process be broad-based, including administrators, teachers, parents, community representatives, and students? Do parents and other community members truly have access to and opportunities for significant involvement?

- Will the computers be used to address the broad range of critical needs identified by the school and the community? How will the particular resources, needs, abilities and goals of urban schools and poor and minority communities be taken into account?

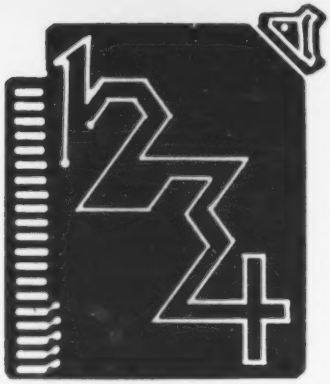
- Will the cost effectiveness of computers be carefully taken into account? Will they be compared to other means of accomplishing the same ends? Will there be opportunities to make use of the knowledge gained from previous and ongoing education research?

- Will computers become part of broad-based vocational preparation, rather than narrowly tied to specific job training? Will they be utilized for academic, civic, and personal development, as well as for vocational preparation?





Are There Solutions?



Are There Solutions?

The rapidity with which schools and school systems are acquiring computers means that in too many instances computers are being introduced without fundamental questions being asked or key issues being addressed. The goal of the conference was to identify and clarify these issues. While the conference raised as many questions as it answered, the discussion suggested guidelines for action in four broad areas of concern:

1) Promoting equitable access of urban students and urban communities to the potential range of benefits from using computers;

2) Shaping and utilizing the technology to meet school and community needs;

3) Preparing students for their future roles as citizens and workers; and

4) Creating opportunities for further analysis and discussion.

1. Promoting Equitable Access for Urban Students and Communities

Perhaps the clearest message emerging from the conference is that the concern for access and equity must remain central. Computers and other technologies, much like other educational resources, flow more readily to affluent schools. Unless specific efforts are made to ensure resource equity, the new technology may well exacerbate existing inequities. Thus, policymakers, and all who influence **policy makers must insist that technological resources be equitably distributed among all schools, and that these resources be accompanied by the requisite human resources,** skilled teachers, staff development, and administrative support.

Access does not simply refer to hardware and software. Funds must be made available to urban schools to pay for the multiple costs associated with the effective utilization of computers. Personnel and software costs far outweigh hardware costs. High quality staff development is expensive, but ultimately crucial to the creative use of computers. Teacher support and training must be a major component of the computer utilization plan.

The acquisition of appropriate software is another critical resource issue. As educators have found in Houston, the need for software might necessitate a large scale development effort. This process is, of course, very expensive for a school district to undertake alone, and raises questions related to licensing, networking, and possibly even marketing and distribution.

A number of participants made suggestions of potentially less expensive and possibly more effective ways for urban school systems to proceed. A number of school systems could come together to form a buyer's cooperative. This would assure developers of a large enough market for their products, and could exercise some influence on software developers, helping them understand and speak to urban students. Still another possibility would be for school systems to pool capital and form a consortium that would produce materials.

The question remains: "who is going to shoulder the costs?" Certainly states should include plans for the fair acquisition and distribution of resources for computers in their education reform packages. The possibility of designating federal funds for computer equity should also be investigated. Many urban school districts already rely on Chapter 1 funding for the purchase of computers, but the eligibility requirements limit the uses.

As schools turn to various non-governmental sources for funds and material support, they need to establish strong guidelines and criteria that affirm equity goals and strategies. The potential costs and benefits of school/business partnerships, human service collaborations, labor involvement and other public/private consortiums must be carefully considered in light of these guidelines.

2. Meeting School and Community Needs

The issue of "whose needs will be met" by the introduction of new technologies is also of central concern. At this point, decisions about educational technology are heavily influenced by the marketing strategies of hardware and software vendors and by the views of experts in the field. Educators who would not think of entrusting most educational decisions to outside experts often let similar experts dictate technological decisions. They do this not because they seek to avoid responsibility, but because there is heavy pressure to "do the right thing," little accepted wisdom on what the right thing is, and a plethora of experts in educational technology.

These same pressures make it extremely difficult, if not impossible, for parents or other community members to participate in decisions about educational technology, particularly in urban poor and minority communities where access to technology is most limited. Often, resources devoted to educational technology are effectively removed from community participation in urban schools. While the lack of democratic participation is an issue for all schools, it is of greatest concern among poor and minority communities where community values, interests, and needs are not necessarily understood or protected by those making the decisions.

Two kinds of action are necessary. First and most important, educational decision makers must stop behaving differently when technology is part of a decision. **Urban schools should not defer to external experts on educational technology** any more than they defer to experts on other educational resources. It is, in fact, in the interests of the vendors of educational technology to encourage this more equal partnership and to build expertise in the school-based consumers of their goods. If they do not, many investments in educational technology will fail, which will discourage schools from future purchases.

Secondly, urban school districts, community-based organizations, private and corporate foundations and vendors of educational technology should develop and support programs that **increase community access to and expertise in computers.** Specifically, they should work individually and collaboratively to create model computer education programs that include parent and community involvement. Examples of such programs suggest a wide range of possibilities:

- The Urban League and the Xerox Corporation have developed a collaborative effort to place computers in urban schools in a way that encourages a high level of participation. School districts with at least 100,000 students can apply, with the major criteria being educational and socioeconomic need. The design of the program must include a concentration of experience for students in the use of computers to enhance writing and language arts skills, and must include community and parent use.

- The **Saturday Academy** is a public school enrichment program for 7th graders and their parents sponsored by the Aetna Institute for Corporate Education in cooperation with the Hartford Board of Education. The academy, housed at the institute headquarters, offers oral communication, computer literacy and math/science. The computer literacy component focuses on hands-on classroom activities for parents and students and includes a computer loan program.

- In Houston, the **Technology Department** of the school system has identified the involvement of parents as a critical element in their computer utilization plan. They have instituted a parent loan-out program, as well as a software library and training opportunities for parents.

Such efforts lay the groundwork for community participation in immediate decisions concerning the resources devoted to educational technology. They are also important first steps to more long-range collaborative planning. Computers are potentially a powerful new resource for addressing the problems of urban schools and urban communities. Community and school representatives who feel comfortable with the technology and with each other can work together to **identify community needs and community resources,** and to include applications of computer technology in specific strategies to address those needs.

Some school systems across the country have begun to experiment with school site improvement councils that include parents, teachers, administrators, community members and representatives from nonprofit organizations and local corporations. Within such a planning process, both the promise and the problems of the new technologies could be carefully considered. The council could have oversight of the planning for the procurement and utilization of the computers, as well as the monitoring and evaluation of the educational programs that are developed.

3. Preparing Students for their Future Roles as Citizens and Workers

The issue of whether students need to be computer literate for their own and the nation's economic survival proved extremely controversial at the conference. As economic analysts argued about the extent of corporate and public need for computer-literate graduates, community activists and advocates observed that whether computer skills are really necessary is not the issue. The point, they argued, is whether graduates with such skills will have a better shot at jobs than those without them.

The recommendations that emerge from this discussion are twofold. First, **urban schools must be careful to ensure that their graduates appear at least as qualified as other candidates for scarce jobs.** Minimally, this means that educators should make special efforts to ensure equitable access to computers for girls, minorities, and students from poor backgrounds. Although the educational system alone cannot reverse the economic and educational disadvantages experienced by these groups, the goal should be to narrow rather than widen the gaps by giving them the best education and the fullest set of credentials possible. In some cases this means providing skills which are not strictly necessary from a job-skill analysis, but which are widely believed to be necessary.

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Second, it is very important that computers, like other school resources, be used to **maximize students' preparation for active roles** as future citizens and workers in a democratic society. There is surprisingly widespread agreement among many educators, community leaders and employers that all students need skills in reading, writing, communication, computation and reasoning. Whether headed to college or directly to work, they must be prepared for lifelong learning and earning.

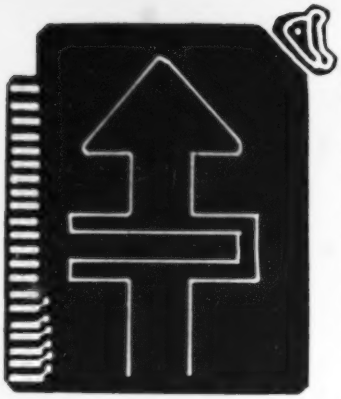
Many disadvantaged students tend to be in the "vocational track" in their high schools. Within the vocational track, they tend to be in training for low wage and low-skilled occupations. The perpetuation of disadvantage through such tracking practices is a matter of concern in its own right. In addition efforts must be made to reassess and revise the curriculum of vocational education. Instead of training students for a single occupational role within an economic enterprise, **vocational courses should provide students with the opportunity to understand all aspects of an enterprise,** as well as a broad exposure to a range of work settings.

Moreover, the primary purpose of education should not be limited to enabling people to continually adapt to an ever-changing labor market. **Schools should educate students to understand the transformations that are taking place in the economy** generally, as well as the specific job transformations accompanying the introduction of computer technology. Schools could do much more to infuse knowledge about and use of computers into many courses and subject areas.

4. Creating Opportunities for Further Analysis and Discussion

Participants at the conference were unanimous about the need for more discussion, research and analysis on the potential and pitfalls of educational technology in urban settings. Opportunities to identify and clarify the issues and the relevant evidence that bears on those issues are all too rare. As a first step, schools and **school systems should be given support to document and evaluate existing programs.** Case studies that illustrate interesting uses of computers in the schools and analyze the critical elements of such programs would be particularly useful.

Secondly, researchers and policy analysts should be encouraged to explore the implications for urban schools of a technologically developing society and a rapidly changing economy. How do these changes impact on school organizations, pedagogy, and resource allocation? How, in turn, can urban schools play an active role in identifying and addressing community needs?



A Final Word: Equity and Excellence

Schools have long been a central arena in the struggle for equal opportunities in this society. They continue to be so. In the past two years of renewed debate about education, equity and excellence have too often been presented as separable or even contradictory goals. Yet, excellence in the schools can only be achieved if attention is paid to the barriers jeopardizing the education of poor and minority students.

This perspective raises specific concerns that must be addressed regarding the introduction of computer technology into the schools. Educational technology resists equity much as any other resource does. Many of the comments made at the conference are no less true if we substitute some other educational resource for computers. Yet, computers cannot simply be looked at as just "another resource" that is more available to the "haves" than to the "have nots." If school systems continue on their present course, the new technology may well exacerbate existing inequities in subtle but powerful ways.

Policies and practices that support the equitable uses of computers must be put into place. The major action required is careful, sensitive use of educational technology to serve the diverse needs of students who have already been treated inequitably. **The first step is to insist that technological resources flow equitably to all schools, which will probably entail providing extra support to urban schools.**

Secondly, we must not expect computers to serve urban schools or communities any better than other resources, unless computers are used more carefully, wisely, and constructively than other resources have been used. A new resource, no matter how dynamic, will not improve the quality of education if teachers and administrators continue to hold low expectations for their students and if schools and communities remain isolated from one another. Students will only receive the benefits of the new technologies if these resources are brought into the schools by **teachers and administrators who believe in their students' potential to learn and who view computers as a new tool for motivating and educating them.**

Appendix A
Speakers

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Houston Independent School District

Marc Tucker
Project on Information Technology and Education

Sam Husk
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John Lawson
Massachusetts Department of Education

Barry McLaughlin

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Exxon Educational Foundation

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Charles Thompson
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Education Development Center

Martha Stone Wiske
Educational Technology Center
Harvard Graduate School of Education

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"The introduction of computers into schools will not change the response of schools to poor and black kids. The focus on technology must not divert us from the moral and political concerns that are more the cause of problems than the lack of computers."
Kenneth Haskins

"Urban children must have access to technology at least as sophisticated as that available in suburban areas, opportunities to pursue learning at least as broad and quality that is perhaps greater."
John Grate

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